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p o r t f o l i o d e s i g n

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CONTENTS

BRINGING WATER TO THE FOREFRONT

SNOW RESERVOIR

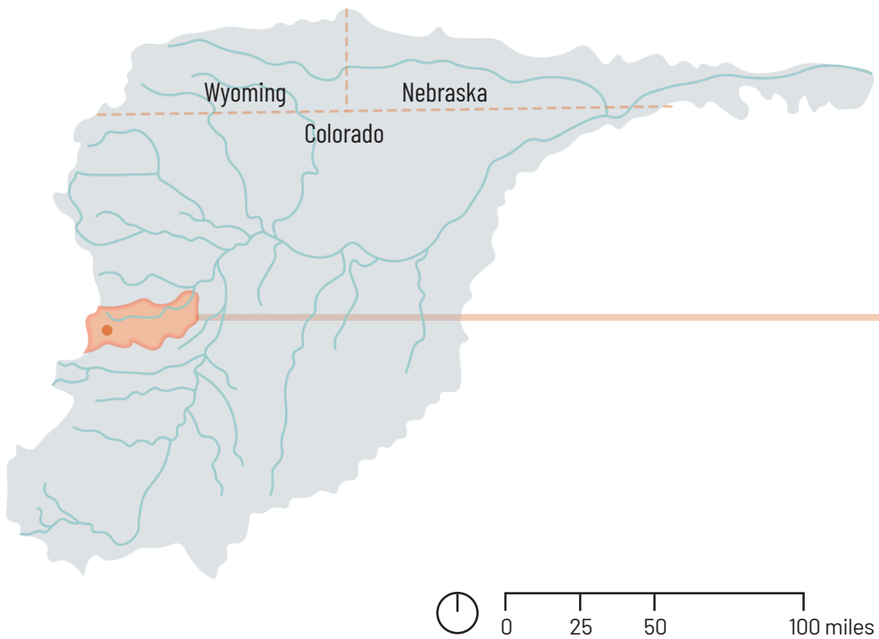
E L D O R A

The ski industry may all but disappear in the coming decades. As climate change progresses the industry has seen little innovation. Snowmaking at Eldora and other resort's like it require a substantial amount of water and energy. Eldora's water use ultimately effects downstream communities within Boulder's watershed. While snowmaking can extend winter recreation, these practices aren't sustainable.

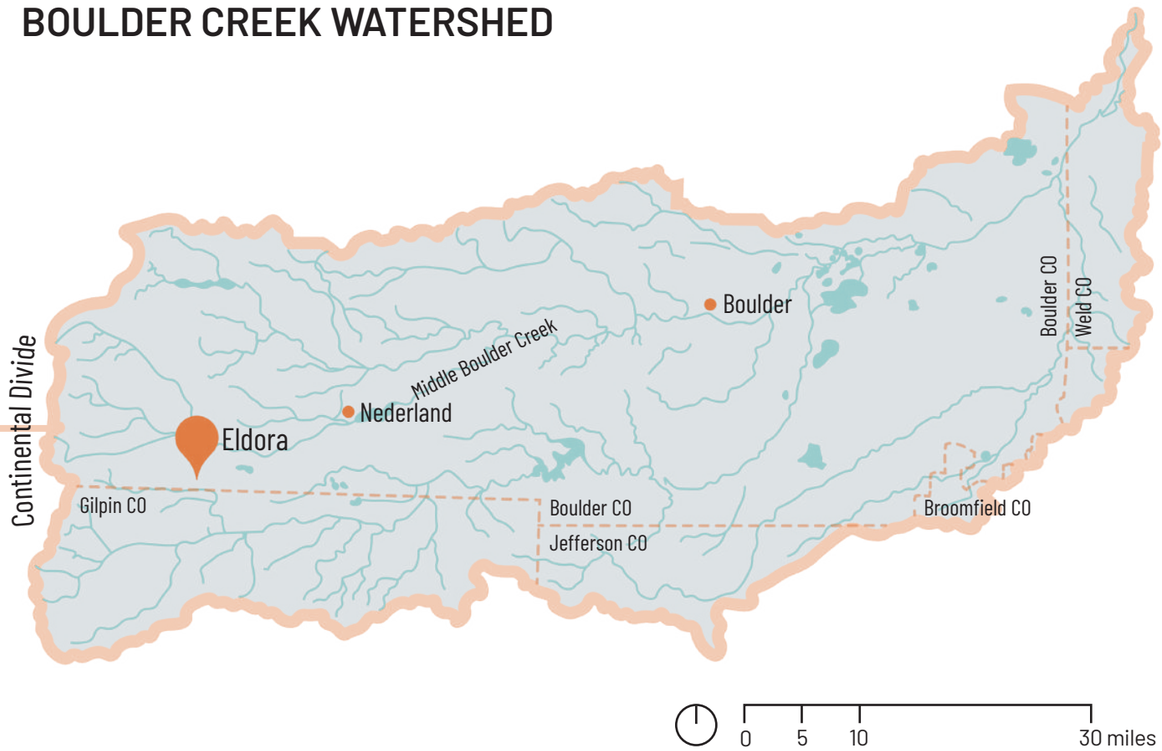
This proposal was made in consideration of the LA+ Interruption Design Competition. The project takes an adaptive approach to climate change. This proposal addresses water consumption, drought, energy use, and fire protection.

Eldora Mountain Resort is in Nederland, Colorado within Roosevelt National Forest. The mountain is 680 acres and makes snow from October through January.

SOUTH PLATTE WATERSHED



BOULDER CREEK WATERSHED



200 THOUSAND
Gallons of water to cover an acre of terrain with a foot of snow

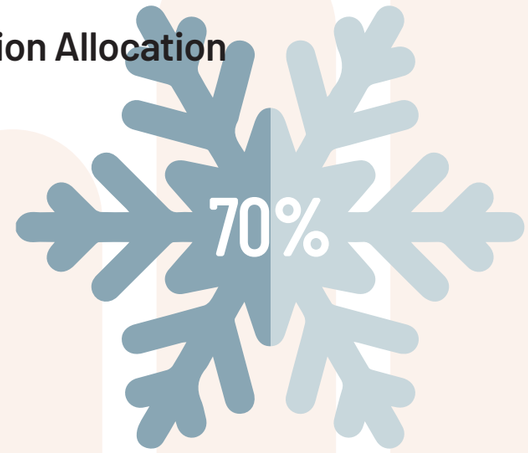
680 ACRES
Total terrain, 53 trails, and snowmaking Oct-Feb at Eldora

Western Water Law

The use of Colorado's water is determined by the **Prior Appropriation System**. This system controls who uses how much water, the types of uses allowed, and when water can be used. Colorado water rights are unique to the state and restrictive to those who don't own water rights. Water rights are not easily acquired, therefore improving water management can be difficult to implement.

Energy Consumption Allocation

Snowmaking accounts for nearly 70% of a resorts total energy consumption (avg)



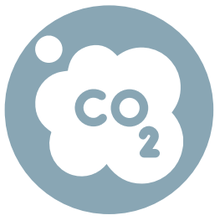
What's a Watershed?

Watersheds are extremely important. Healthy intact watersheds provide many ecosystem services that are necessary for our social and economic well-being. These services include water filtration and storage, air filtration, carbon storage, nutrient cycling, soil formation, recreation, food and timber.

Why's this Important?

Eldora sits in a critical position within Boulder Creek and the greater South Platte watershed. The continental divide—the hydrological divide of the Americas—is only a few miles from the resort. This means Eldora is at the headwaters of the entire Boulder Creek watershed and impacts nearly every US body of water east of it.

Overconsumption Consequences



Emissions

Co2 emissions from excessive water pumping

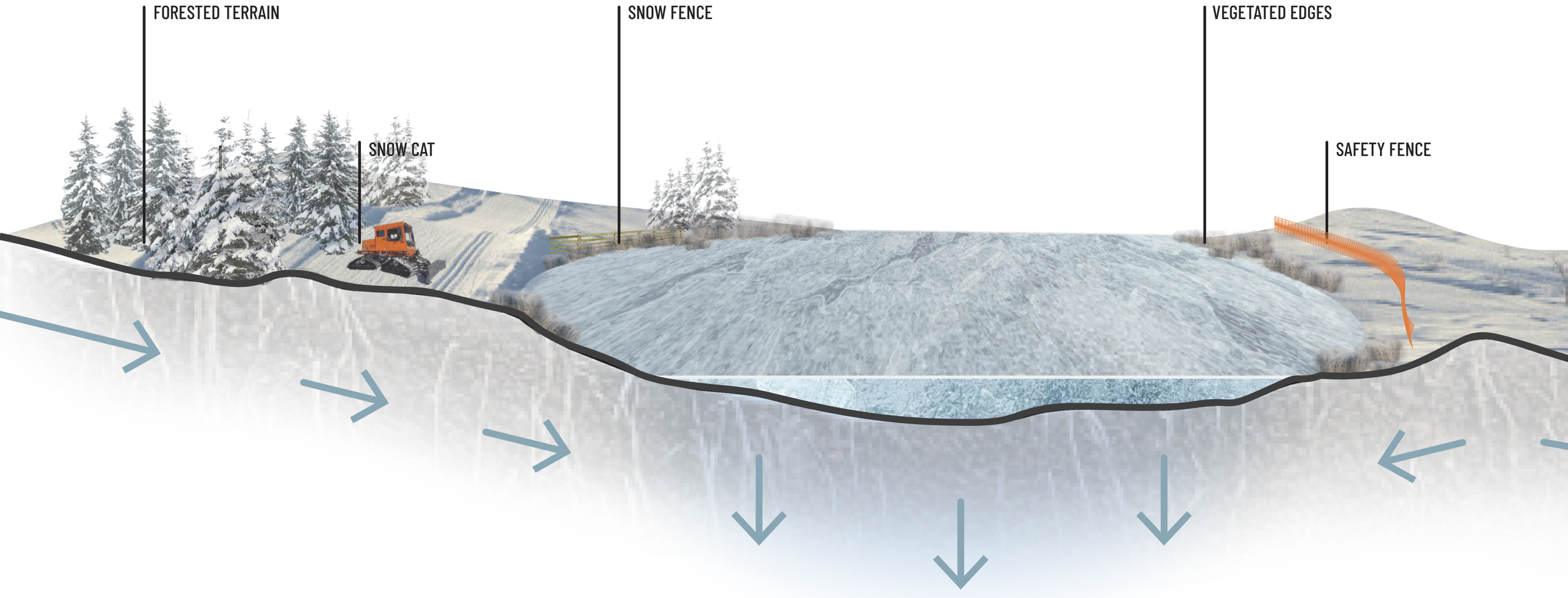
Fire-prone

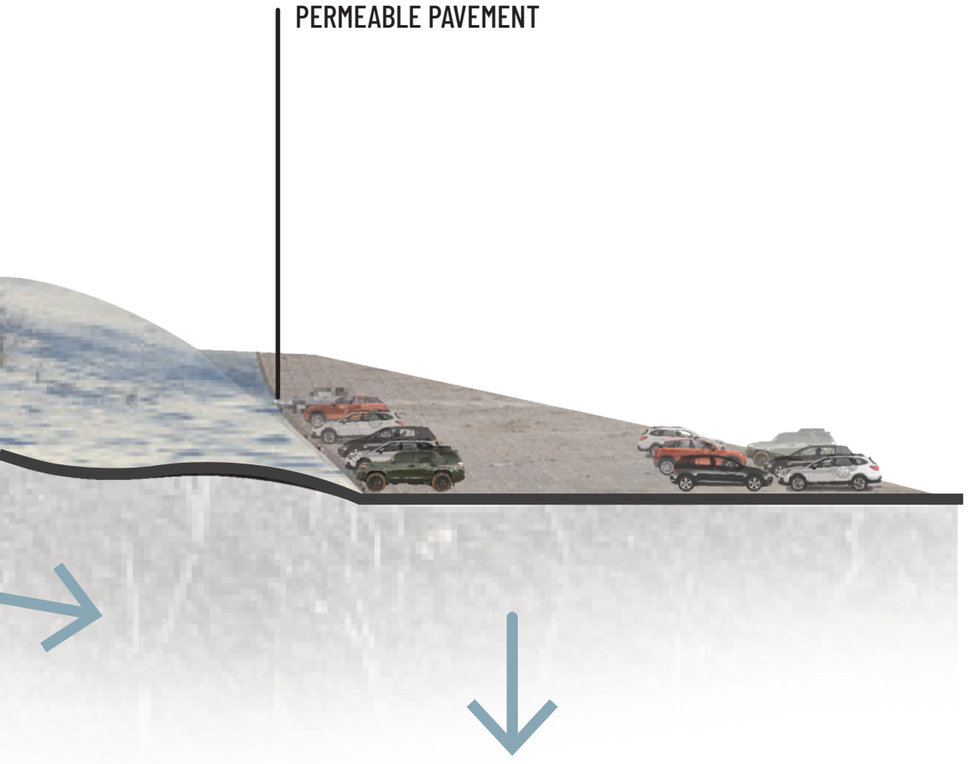
Extensive water use leaves resort vulnerable to fire

Drought

Water depletion causes drought downstream

SNOW RESERVOIR WATER CYCLE

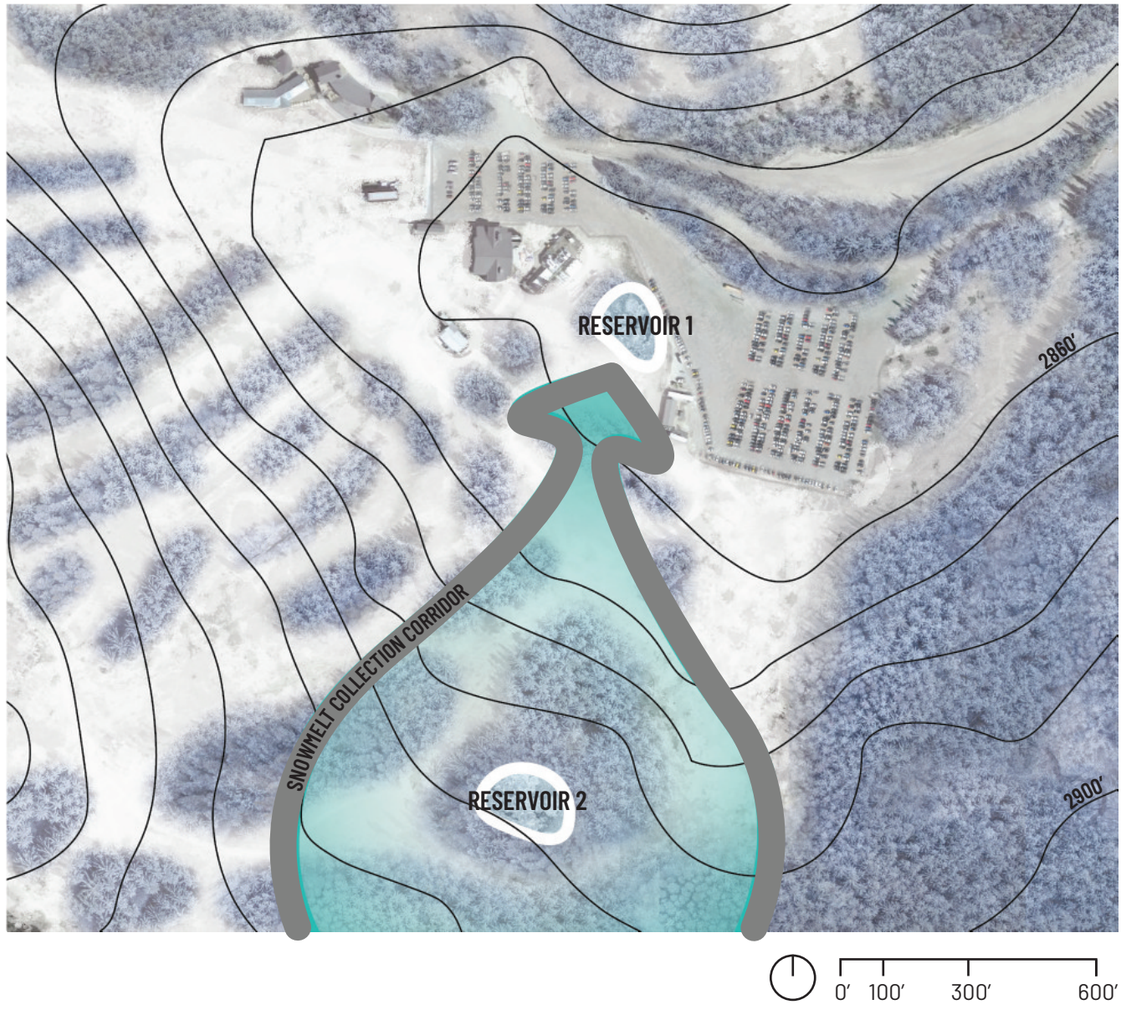




R - PARKING
R ZONE

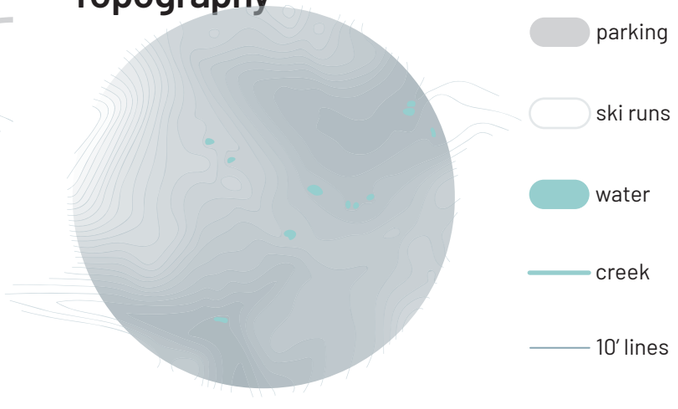
PRIMARY PARKING LOT

HYDROLOGY



Context

Topography



PERMEABLE PAVERS

Install on parking lot edges and areas most vulnerable to erosion

SAFETY FENCE

Place around reservoirs to increased safety measures

SNOW FENCE

Install around reservoir 1 to drop snow at its edges

STRATEGIC SNOW COLLECTION

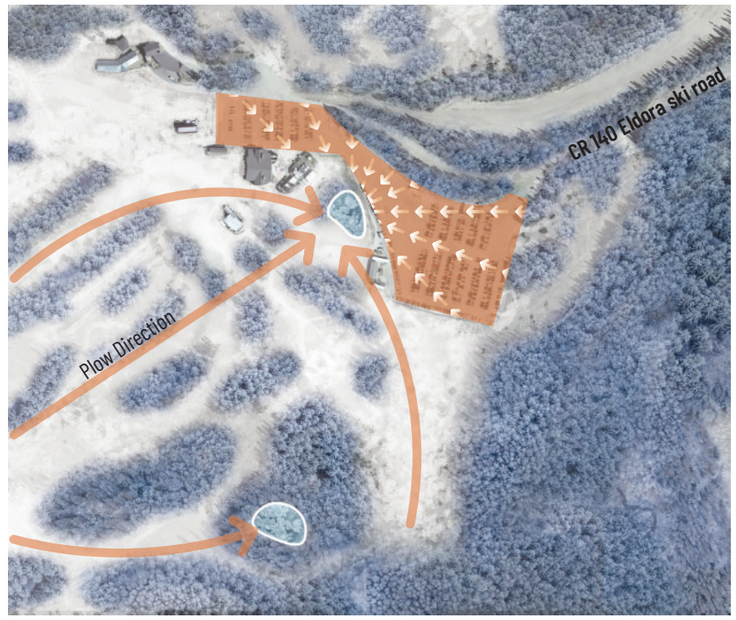
Ski resorts similar to Eldora use ~250 million gallons of water over a single season. **Snowmaking requires a substantial amount of water** and energy. Eldora's water consumption from snowmaking creates harmful consequences for downstream communities.

Snowmaking can extend winter recreation, however this excessive use of water is not sustainable. Permeable pavement, snow fences, **strategic snow collection**, and additional **reservoirs** must be incorporated at Eldora. These additions to the resort will reduce water consumption and put Eldora at the forefront of climate adaptation.

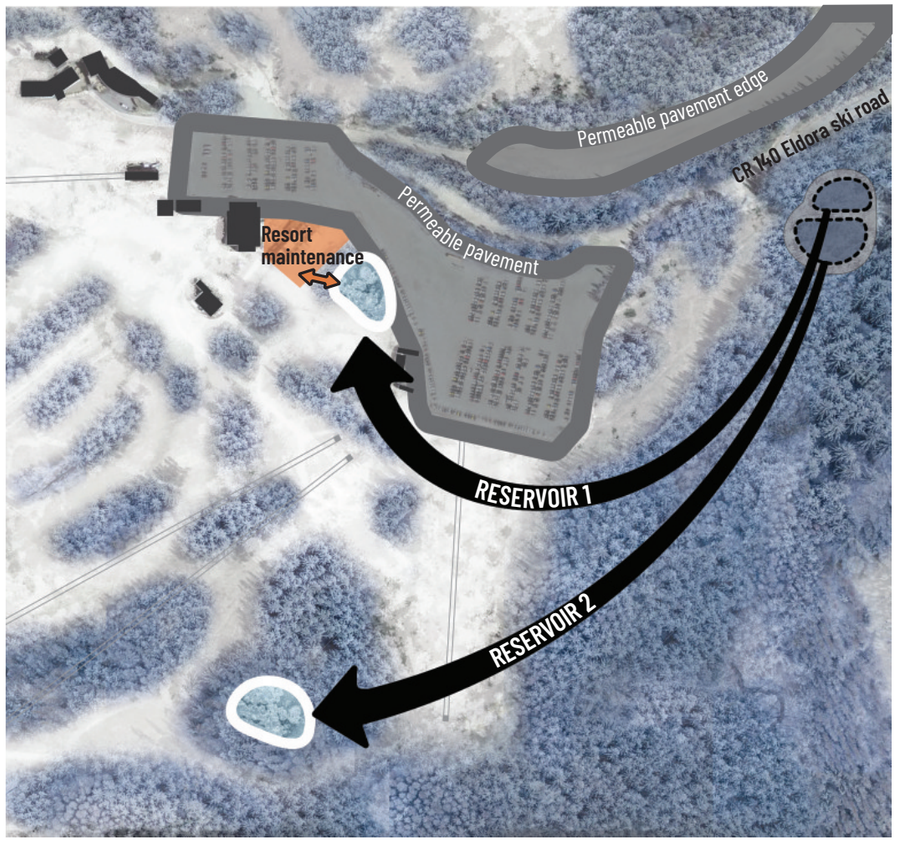
Eldora can adapt to climate change by incorporating two new **reservoirs** and a strategic **snow collection** plan. The reservoirs would be closer to ski runs and rely on gravity, not pumping, to collect and **recycle water**. Moving reservoirs closer to runs and snowmaking machines means Eldora could operate on less water and produce less emissions.

Eldora's vehicles can also play a crucial role in reducing water and emissions. **Snow cats** are used at Eldora daily to groom runs and clear parking lots. New routes should be established so snow cats operators push snow towards the new reservoirs. As the snow melts it recharges the reservoirs. Snow cats would expedite the time it takes to **recharge reservoirs** so no excess water is required to be pumped from further sources.

SNOW CAT ROUTES



RESERVOIRS DIAGRAM



PROPOSED RESERVOIRS

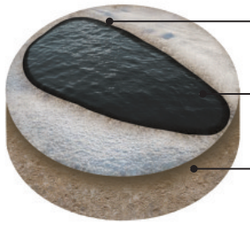
Increased fire protection

More water returned to watershed

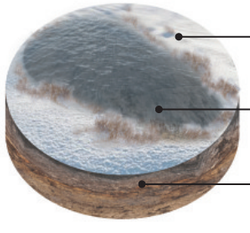
Increased erosion control

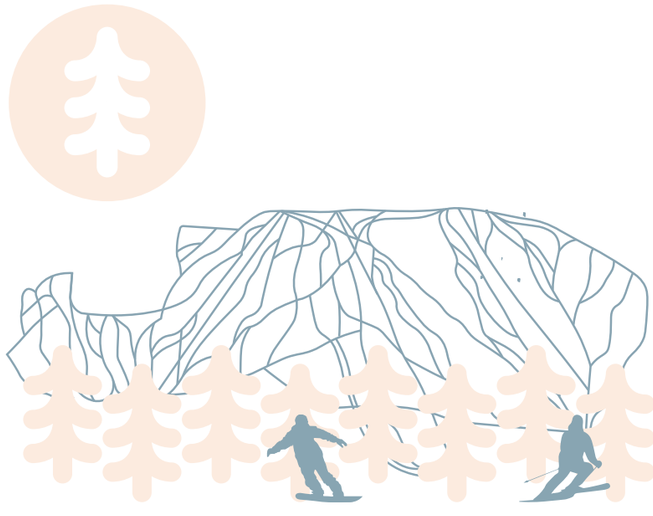
Reduces emissions

Existing Retention Pond



Proposed Snow Reservoir





PATH TO SUCCESS

Rather than concealing reservoirs, water should be brought to the forefront. Visible reservoirs remind and educate visitors that this industry is water intensive.

Updating water processes is an essential step for resort's to address climate change. With this proposal, Eldora ski resort can serve as an innovator on the forefront of change in the community.

CREST VIEW ELEMENTARY

EXPANDING THE HABITAT

Crest View Elementary School is located in Boulder and in the Boulder Valley School District. The school property is 17.27 acres and has 537 students.

Climate change posses a unique threat to the community of Crest View. In 2013, a 100 year flood event devastated the school and destroyed their outdoor education space known as The Habitat. The flood left The Habitat unusable and these unresolved water issues still persist today.

Meeting with school faculty and organizing student engagement activities was crucial to complete this design. Student, parent, and faculty feedback expressed a strong desire to fix The Habitat.

In this proposal, The Habitat is redesigned and expanded onto the rest of the site. In order to achieve a successful habitat the design also deals with flooding. This design takes an adaptive approach on water to prevent flood damage. The proposal addresses water, outdoor education and touches on erosion, safety and accessibility.

Environmental Design

1990

The Habitat is completed by Design Concepts and receives multiple awards

1990 - 2012

The Habitat is enjoyed by students to learn and play

2013

Flood raises the sites water table and damages school property including The Habitat

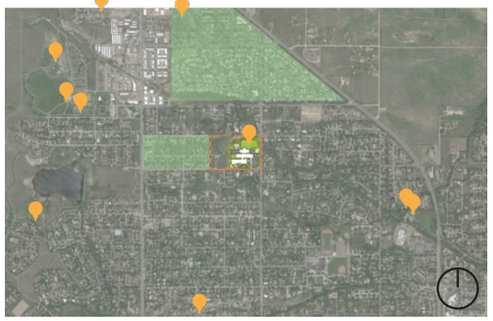
2013 - Present

The Habitat is not in use due to drainage issues on site

2022

CU design team redesigns The Habitat and extends it into the schoolyard

Greater Context

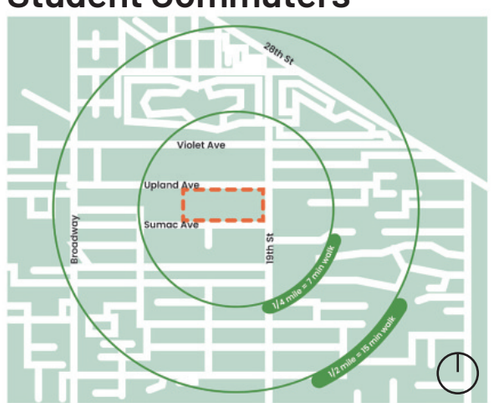


BVSD property
existing playgrounds
commuter neighborhoods

Existing Circulation

paved sidewalks
roads and parking
pedestrian path
BVSD property

Student Commuters



BVSD property

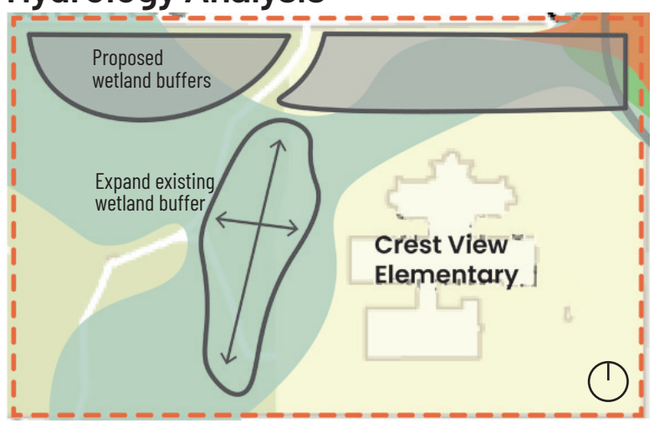
Existing Hydrology

100 yr floodplain
high hazard zone
conveyance zone
BVSD property
wetland buffers

Key Takeaways

Several site visits and a look at the floodplains show that much of Crest View is within the 100 year floodplain the water table has risen. Both the conveyance and high hazard zone also run across the northeast corner of the property. The hydrology suggests a threat to the school.

Hydrology Analysis



100 yr floodplain
wetland buffer
conveyance zone
BVSD property

Proposed Hydrology

Key Takeaways

- North and West sides are vulnerable
- Four Mile Creek drainage on Northeast corner
- Drainage near building harmful to foundation

Wetland buffers are suggested on the North and West sides of the building. Bioswales are an effective solution for the area. These buffers will prevent future flooding by slowing, sinking, and spreading water across the area.

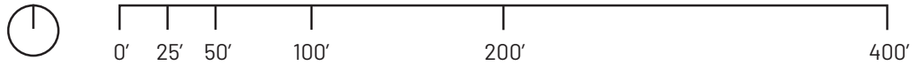
Proposed Circulation

Pedestrian
primary
secondary
tertiary

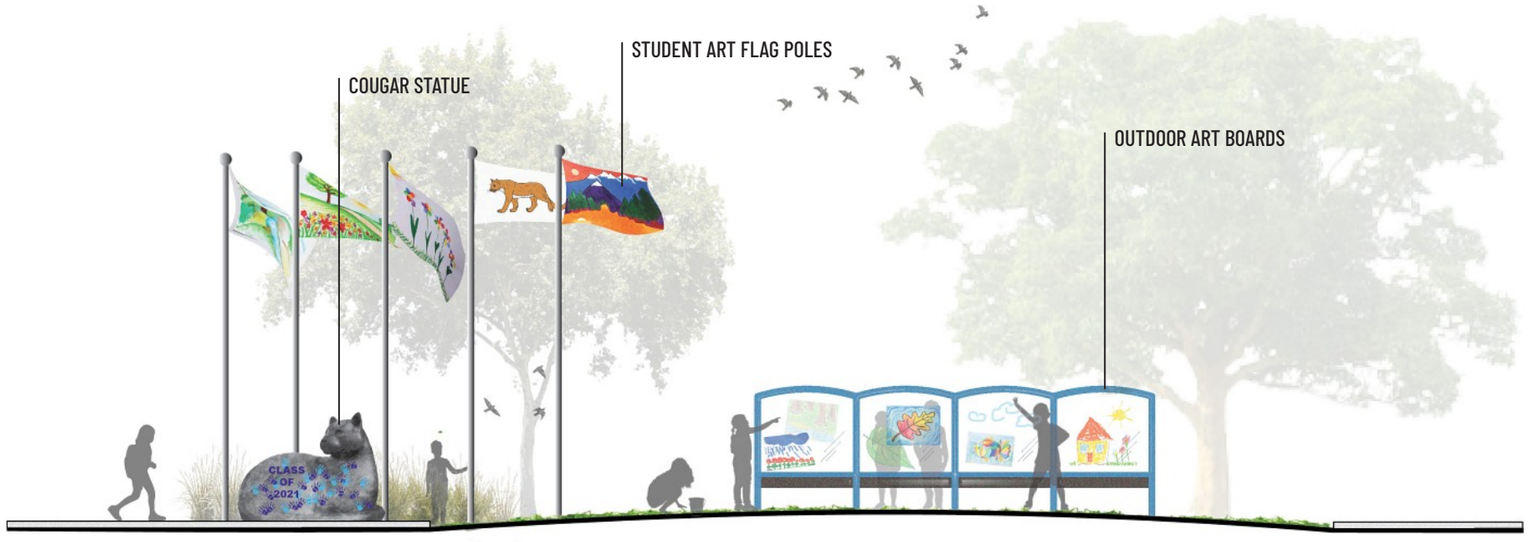
Vehicle
primary
secondary

EXISTING AND **PROPOSED SPACES**

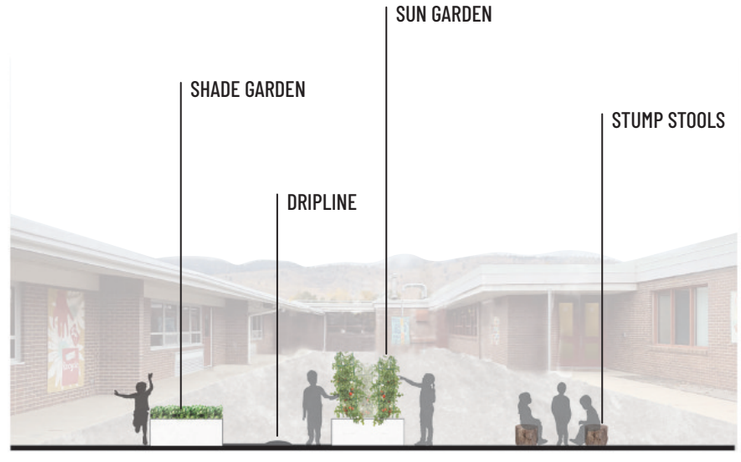
1 Boardwalk
2 Outdoor Classroom
3 Playground
4 Grass Field
5 Asphalt Playground
6 Sand Pit
7 Parking
8 Seasonal Planting
9 Garden
10 Garden Classroom
11 Nature Waiting Area
12 Arts Area
13 Bioswale
14 Prairie
15 West Garden



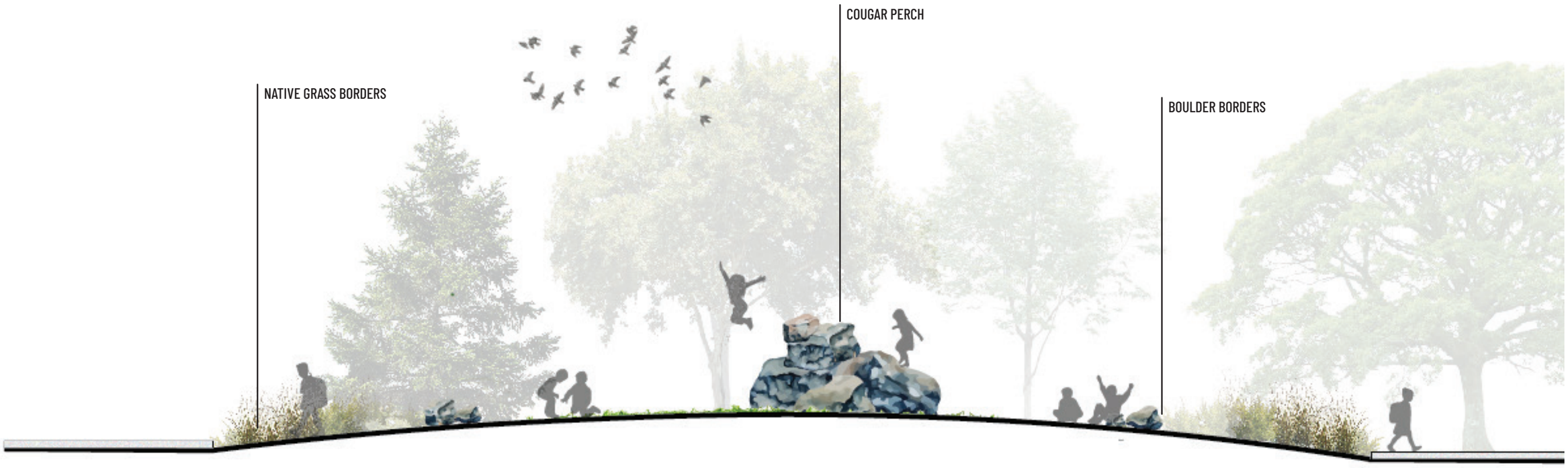
ARTS AREA



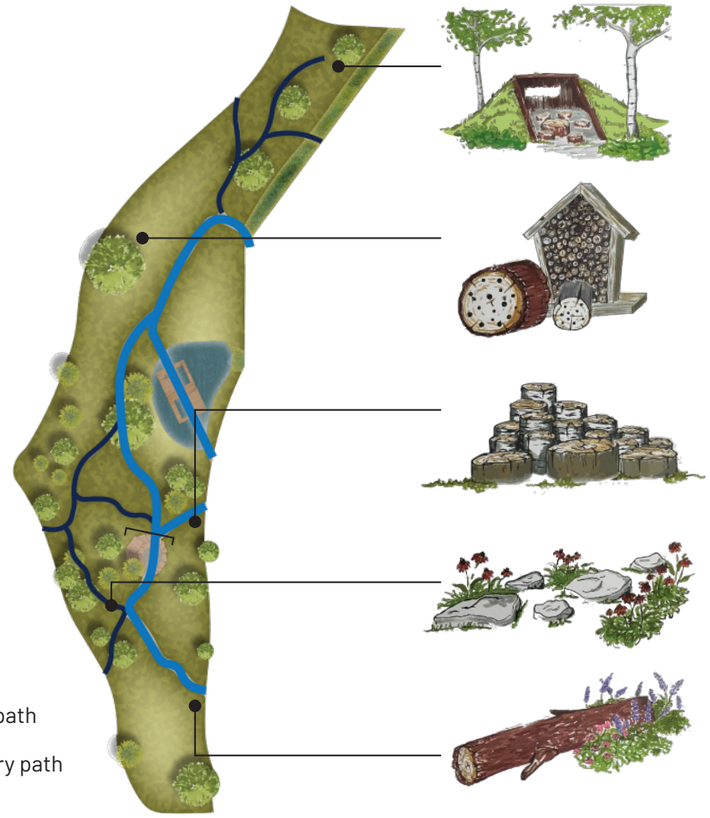
GARDEN CLASSROOM



NATURE WAITING AREA



HABITAT ADDITIONS



AREAS OF ENGAGEMENT

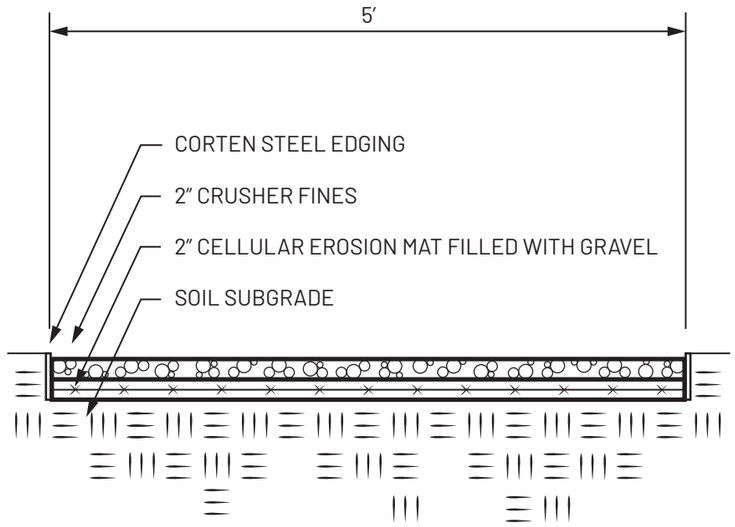
Areas for nature play are easy to construct and should be scattered through The Habitat. The conceptual drawings (shown to left) include a gathering pit, native bee habitat, balance stumps, stepping stones, and a fallen log.

PLANTING & MAINTENANCE

Maintenance and a complementary planting palette will ensure the success of The Habitat.

The existing native grasses should be cut back in the summers after flowering. Perennial seeds such as bee balm, echinacea, and purple prairie clover should be broadcast throughout The Habitat.

PRIMARY PATH



Path Dimensions

Primary Path: 5′ wide and a cellular erosion mat topped with crusher fines

Secondary Path: 3′ wide compacted soil and crusher fines

OUTDOOR CLASSROOM

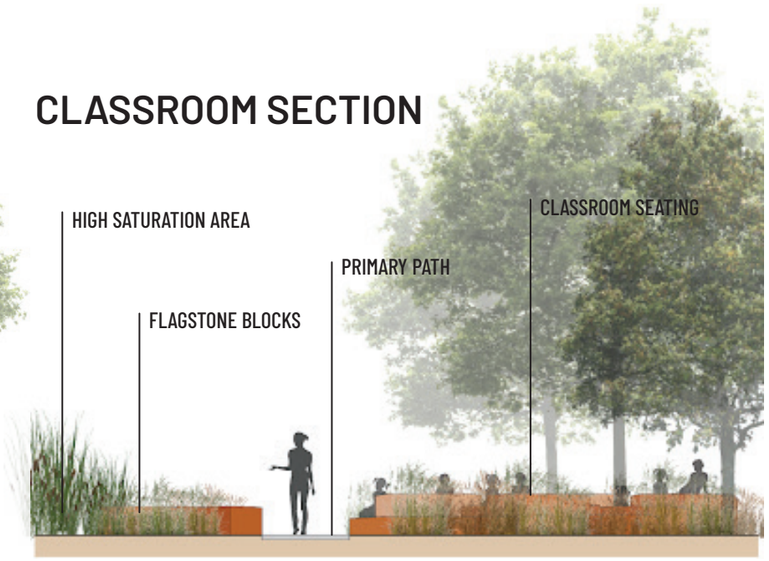
A redesign of the outdoor amphitheater, which was destroyed in the flood, is an essential step for the school. The classroom will be located in The Habitat. It will be accessible from two sides of the primary path.

Both entrances maintain a width of 5 feet to ensure accessibility for all students. Like the primary path, the ground can be stabilized with cellular erosion mats and crusher fines. The new design expands the classroom to a 30 foot diameter so the space is available to larger classes. Flagstone blocks will serve as seating.

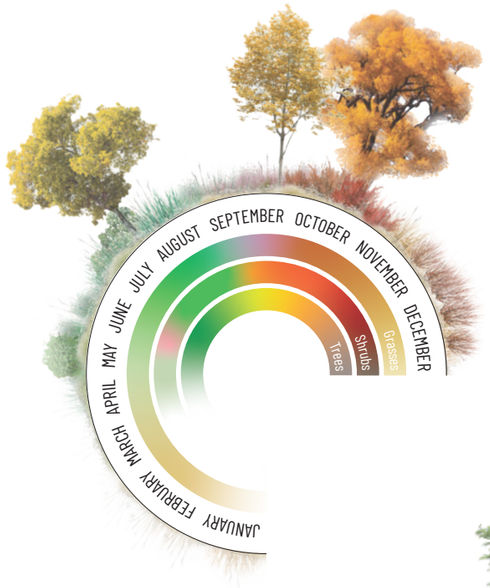
The materials in the design were chosen because they can withstand erosion from flooding, can be easily repaired, and are locally sourced from the area.

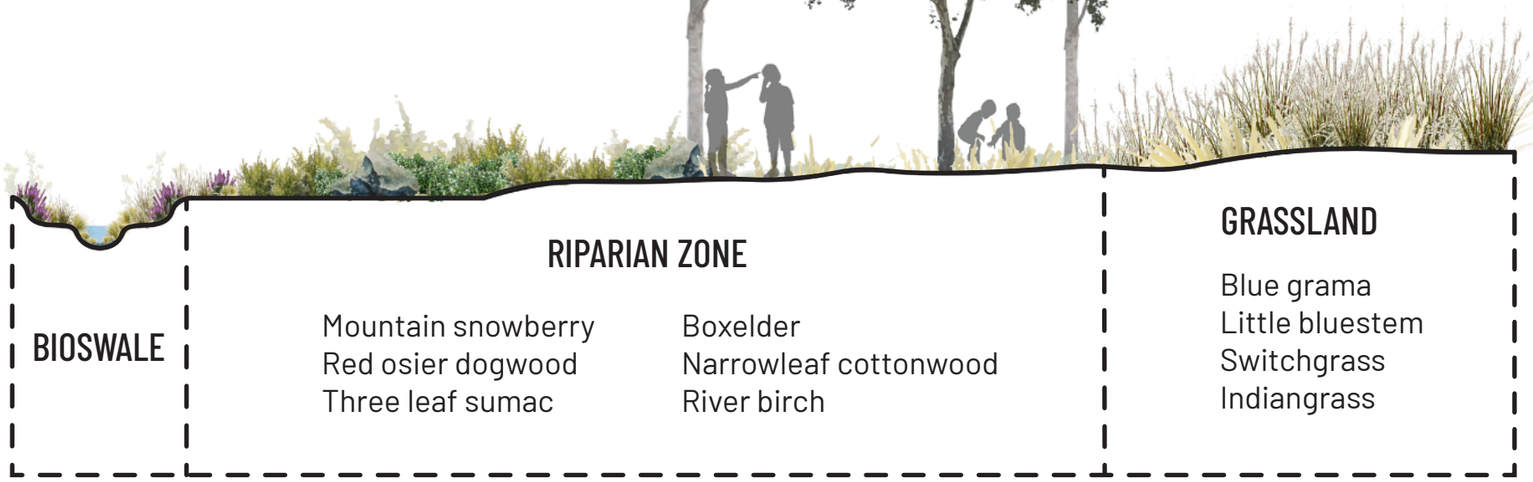
CLASSROOM PERSPECTIVE

CLASSROOM SECTION



THREE ECOSYSTEMS: GRASSLAND, RIPARIAN, & THE BIOSWALE





ECOSYSTEM OVERVIEW

In the design, The Habitat would be planned to extend to the North edge of the site. The new Habitat would feature three ecosystems, grassland, riparian, and the bioswale. Here, students can learn about their environment through their own exploration. They could walk through two miniaturized Colorado ecosystems and learn the function of a man made ecosystem, a bioswale.

GRASSLAND

The grassland will be located along the North edge of Crest View's property. All the grasses selected in the design are found in Colorado prairies and include blue grama, our state grass.

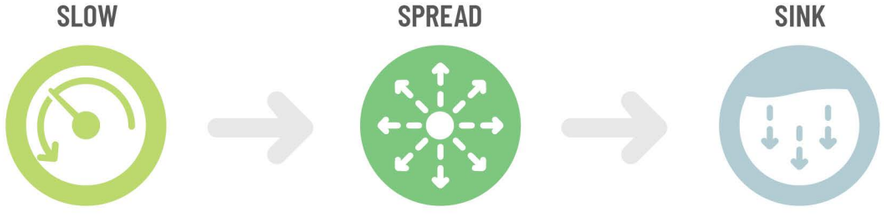
RIPARIAN ZONE

The riparian zone accompanies the bioswale for most of its length. All the shrubs and trees chosen for the area, are commonly found along riverbanks and in floodplains. The plant selection would help manage the high water table and mitigate future flood impacts.

THE BIOSWALE

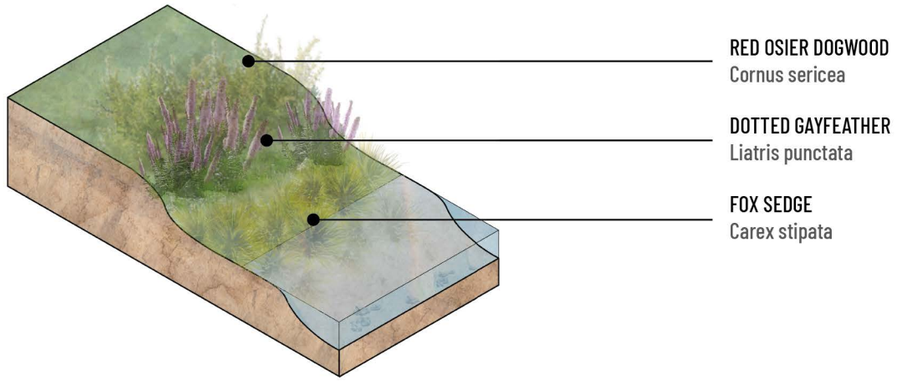
The bioswale design is an area for education, play, and protection from future floods. The bioswale would measure 6′ wide and 3′ at its deepest.

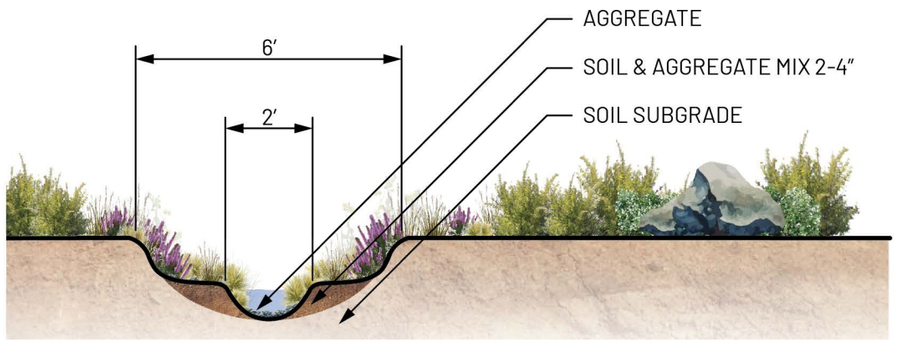
The bioswale design can be separated into three sections. Each section serves a purpose to protect the school from flooding. The bioswale would occupy the Northwest end of the site so that it may stop water from flowing Southeast across the property.



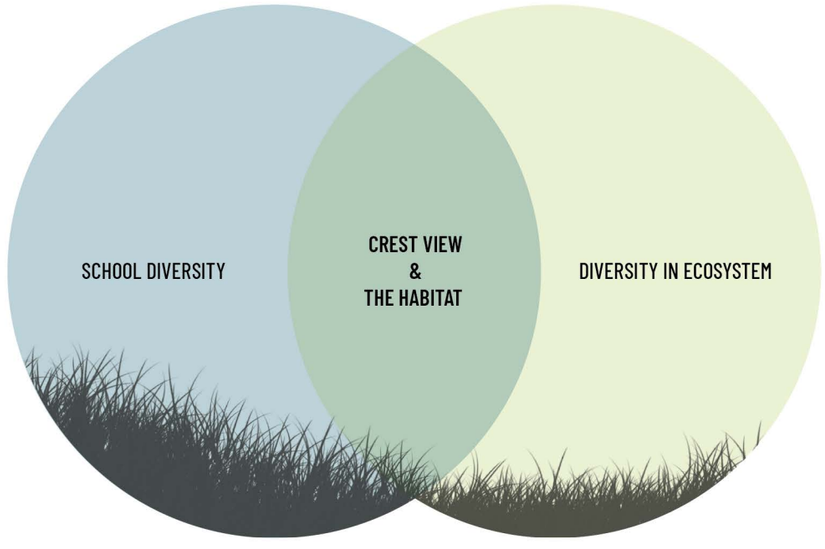
BIOSWALE LOCATION

BIOSWALE PLANTS





CONCLUSION



The proposed redesign of The Habitat extends the playful and diverse atmosphere of Crest View onto the property. The bioswale immerses students in nature while also protecting them. Reconnecting the school to its diverse ecosystem encourages students to learn and explore.